UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7
11201 Renner Boulevard
Lenexa, Kansas 66219

MAR 2 1 2017

RCRA

560514

Mr. Lawrence C. Rosen
Environmental Operations, Inc.
1530 South Second Street, Suite 200
St. Louis, Missouri 63104-4500

RE: Comments on the January 24, 2017, Indoor Air Sampling Results for the Ahrens Office Building at the Former Solutia - J.F. Queeny Site, St. Louis, Missouri
EPA ID # MOD004954111

Dear Mr. Rosen:

The U.S. Environmental Protection Agency Region 7 in consultation with the Missouri Department of Natural Resources, has completed its review of the subject sampling results and are providing the following comments.

1. Cis-1,2-dichloroethene and vinyl chloride should be added to the list of analytical constituents for future indoor air samples collected at the Ahrens office building, as they are breakdown constituents of trichloroethene that can pose a potential health risk when present above their respective screening level threshold concentration.

2. The current EPA Region 7 vapor intrusion risk management guidance (enclosed) recommends that continued indoor air monitoring or vapor intrusion mitigation be performed at the Ahrens office building based on the most recent sub-slab and indoor air sampling results. Although the approved work plan for vapor intrusion sampling at the Ahrens property calls for one additional round of indoor air sampling later this spring, additional indoor air sampling consistent with the EPA guidance (OSWER Publication 9200.2-154) would be appropriate given current site conditions.

3. Pre-emptive vapor intrusion mitigation for the Ahrens office building should be considered at this time. The rationale for mitigation is supported by several significant site conditions. First, the sub-slab TCE vapor concentrations are as high as 285 times the soil gas industrial exposure action level; Second, limited indoor air sampling has demonstrated the likelihood of sub-slab TCE vapor migration into the indoor air; Third, TCE poses significant health risks from acute exposures as well as chronic exposures; and fourth, indoor air TCE concentrations are relatively close to the TCE action level. Furthermore, consideration should be given to the cost of installing a vapor intrusion mitigation system versus quarterly indoor air sampling for the foreseeable future.

If you wish to discuss this matter further, please call me at (913) 551-7755.

Sincerely,

Bruce A. Morrison
Project Manager
Waste Remediation and Permitting Branch
Air and Waste Management Division

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 7
11201 Renner Boulevard
Lenexa, Kansas 66219

FEB 2 4 2017

MEMORANDUM

SUBJECT: Revised Vapor Intrusion Risk Management Decision Matrix
U.S. Environmental Protection Agency Region 7
Lenexa, KS

RECEIVED
FEB 2 7 2017
AWMD/WRAP IO

FROM: Mike Beringer, Chief
Environmental Data and Assessment Branch
Environmental Sciences and Technology Division

TO: Air and Waste Management Division and Superfund Division Managers

Per this correspondence, the Environmental Sciences and Technology Division is transmitting the revised *Vapor Intrusion Risk Management Decision Matrix*. Consistent with the *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air* (EPA, 2015), the matrix applies multiple lines of evidence to evaluate the vapor intrusion exposure pathway, focusing on sub-slab soil gas and indoor air data, for the purpose of managing potential human health risks. Following are the changes and clarifications incorporated in this revision.

The revised *Vapor Intrusion Risk Management Decision Matrix* identifies appropriate Region 7 response actions (or non-actions) to address a range of potential health risks posed by the vapor intrusion exposure pathway. Accordingly, "action levels" rather than "screening levels" are used to define low, medium, and high risk scenarios, based on sub-slab soil gas and indoor air concentrations.

Except for trichloroethylene, the matrix indoor air action levels are the most current EPA Regional Screening Levels for air. For TCE in indoor air, the EPA Region 7 action level for a residential scenario is 2 $\mu g/m^3$, and the action level for a typical industrial/commercial scenario with an 8-hour workday is 6 $\mu g/m^3$ (EPA, 2016). These action levels are based on the TCE chronic reference concentration of 2 $\mu g/m^3$ and a 1-day critical exposure period of concern used to evaluate the potential for cardiac malformations during early pregnancy. If a TCE action level is needed for an alternative exposure scenario (e.g., 10-hour workday), we recommend consultation with an ENST human health risk assessor to ensure protectiveness. Because even acute exposures to TCE concentrations above the action level may pose significant health risks, a rapid response is warranted to quickly minimize exposures to TCE vapors emanating from subsurface exposures. Note that the TCE chronic reference concentration is based upon a large number of studies and multiple types of non-cancer endpoints, including effects on the adult immune system and kidneys, so response actions are necessary to protect all potential human receptors, not only women who are or could become pregnant.

The matrix sub-slab soil gas action levels are derived by applying a generic attenuation factor of 0.03 to the indoor air action levels. The most current EPA Vapor Intrusion Screening Level calculator applies this attenuation factor and may be used to calculate sub-slab soil gas action levels for all contaminants of

concern except TCE, which has a Region 7-specific action level for air. The VISL calculator is generally updated biannually with the RSL tables. Caution should be employed if the site conceptual model is inconsistent with the generic conceptual model used to develop the 0.03 attenuation factor. Groundwater entering the building, very shallow groundwater (less than 5 feet below ground surface), shallow soil contamination, preferential pathways, or significant building openings may result in unattenuated or enhanced transport of vapors towards a receptor (EPA, 2014). Because attenuation between building crawlspaces and living spaces is limited, the generic attenuation factor for crawlspace vapor is 1.0 (EPA, 2015).

The revised *Vapor Intrusion Risk Management Decision Matrix* is intended to evaluate the maximum concentration of each vapor-forming chemical detected in a data set representative of the exposure scenario. In Region 7, a representative data set typically includes one year of quarterly vapor intrusion samples to account for seasonal variability. The number of collocated indoor air and sub-slab soil gas samples needed to assess spatial variability depends on building use(s), size, and configuration. An inventory of the building construction/use, basement/foundation condition, heating/ventilation/cooling system configuration, and chemical storage/use is recommended to support sample placement and matrix-based decision making. Outdoor air should be sampled concurrently with the indoor air and sub-slab samples to adequately evaluate the vapor intrusion pathway.

Although multiple samples are recommended to assess temporal variability, early action or preemptive mitigation may be warranted if early sampling results identify potential health effects from acute or short-term exposure, explosion potential, or a high cancer risk or hazard index. Preemptive mitigation may also be appropriate when indoor air data are not available but other lines of evidence indicate the potential for a complete vapor intrusion pathway exists that may pose an unacceptable risk to human health. For example, if a large number of occupied buildings are located above a shallow groundwater contamination plume, vapor intrusion sampling in a few of those buildings may determine the need to mitigate a larger number of those structures. Where sub-slab soil gas or shallow groundwater concentrations are above action levels and slab integrity is needed to confer protectiveness, preemptive mitigation strategies such as sealing floor cracks or establishing positive building pressure may be recommended regardless of indoor air results.

A decision to terminate monitoring requires professional judgement and should consider the subsurface source and data from all affected media. Current and reasonably expected future conditions should also be considered in this decision, especially when subsurface remediation and mitigation activities are ongoing, remediation and mitigation activities are not conducted, or building use or configuration is subject to change. For example, if a groundwater plume is expanding or migrating, soil gas and indoor air concentrations (and associated risk to building occupants) may change with time. If the site conceptual model is adequately characterized and four quarters of vapor intrusion sampling have been completed, site-specific attenuation factors can be developed for sub-slab soil vapor and groundwater. These attenuation factors, combined with periodic groundwater monitoring data, may be sufficient to demonstrate the vapor intrusion pathway does not pose a health concern to building inhabitants. Alternatively, confirmatory sub-slab soil gas and indoor air sampling may be necessary to verify protectiveness (e.g., once remediation and mitigation activities are complete, or to support an ongoing remedy in the Five-Year Review process).

We strongly encourage site managers to consult with ENST/EDAB hydrogeologists and human health risk assessors who have extensive experience with evaluating the vapor intrusion pathway. Doing so will enhance consistency across sites in Region 7. In addition, the revised *Vapor Intrusion Risk Management*

Decision Matrix is not intended to provide guidance to other Regions, States, local organizations, or other entities.

If you have any questions, please contact Dan Nicoski of my staff at x7230.

References

Environmental Protection Agency. 2014. *Vapor Intrusion Screening Level (VISL) Calculator User's Guide*. Office of Solid Waste and Emergency Response. May.

EPA. 2015. *OSWER Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air*. OSWER Publication 9200.2-154. June.

EPA. 2016. *EPA Region 7 Action Levels for Trichloroethylene in Air*. Memorandum from Mike Beringer to AWMD and SUPR Branch Chiefs. November.

Attachment

U.S. Environmental Protection Agency, Region 7
Vapor Intrusion Risk Management Decision Matrix[1]

Soil Gas Action Level[5,6,7,8]	Indoor Air Action Level[4,6,7,8]		
	LOW Cancer Risk ≤ 1E-05 Hazard Index ≤ 1	MEDIUM 1E-05 < Cancer Risk ≤ 1E-04 Hazard Index ≤ 1	HIGH Cancer Risk > 1E-04 Hazard Index > 1
LOW Cancer Risk ≤ 1E-05 Hazard Index ≤ 1	NO ACTION[2]	NO ACTION[2] (Potential Indoor Source)	NO ACTION[2] (Potential Indoor Source)
MEDIUM 1E-05 < Cancer Risk ≤ 1E-04 Hazard Index ≤ 1	Risk Management Decision (No Action[2] or Monitor)	Risk Management Decision (Monitor and/or Mitigate[3])	Mitigate[3]
HIGH Cancer Risk > 1E-04 Hazard Index > 1	Risk Management Decision (Monitor and/or Mitigate[3])	Mitigate[3]	Mitigate[3]

General Considerations:

1 – This matrix is intended to evaluate the **maximum concentration** of each vapor-forming chemical detected in a **data set representative of the exposure scenario**. In Region 7, a representative data set typically includes one year of quarterly samples to assess seasonal (temporal) variability. The number of collocated indoor air and sub-slab soil gas samples needed to assess spatial variability depends on building use(s), size, and configuration.

2 – A decision to terminate monitoring requires professional judgement and should consider the subsurface source and data from all affected media. Current and reasonably expected future conditions should also be considered in this decision, especially when subsurface remediation and mitigation activities are ongoing, remediation and mitigation activities are not conducted, or building use or configuration is subject to change.

3 – Early action or preemptive mitigation may be warranted if an early sampling event indicates high-risk conditions (e.g., elevated cancer risk or hazard index, potential health effects from acute exposure, explosion potential) or when indoor air data are not available but other lines of evidence indicate the potential for a complete vapor intrusion pathway exists that may pose an unacceptable risk to human health (e.g., indoor air concentrations in nearby buildings).

Action Levels:

4 – The Indoor Air Action Level is based on the most current EPA Regional Screening Level for residential or industrial air. For a chemical with an EPA RSL based on cancer risk, multiply the EPA RSL at the 1E-06 cancer risk level by 10 to determine the 1E-05 cancer risk level and by 100 to determine the 1E-04 cancer risk level. For a chemical with EPA RSLs based on both non-cancer and cancer risk, use lower of the non-cancer RSL or the 1E-05 cancer RSL.

5 – The Soil Gas Action Level is based on the target sub-slab soil gas concentration in the most current EPA Vapor Intrusion Screening Level calculator, as calculated for the appropriate residential or industrial scenario and target non-cancer or cancer risk. Note that VISL-based Soil Gas Action Levels may be inappropriate where groundwater entering the building, very shallow groundwater (less than 5 feet deep), shallow soil contamination, preferential pathways, or significant building openings enhances transport of vapors towards a receptor (EPA, 2014).

6 – The TCE **Indoor Air Action Level** is 2 $\mu g/m^3$ for a residential scenario and 6 $\mu g/m^3$ for a typical industrial/commercial scenario with an 8-hr workday. These action levels are based on the TCE chronic reference concentration of 2 $\mu g/m^3$ and a critical exposure period of concern of 1 day to evaluate the potential for cardiac malformations. The TCE chronic reference concentration is based upon a large number of studies and multiple types of non-cancer endpoints, including effects on the adult immune system and kidneys. Thus, response actions are necessary to protect all types of human receptors, not only women who are or could become pregnant. The TCE Soil Gas Action Level should be back-calculated from the appropriate TCE Indoor Air Action Level (see above) using the most current EPA Vapor Intrusion Screening Level calculator.

7 – The difference in attenuation factors for sub-slab soil gas (0.03) and crawlspaces (1) suggests that vapor concentrations from a crawlspace may be more representative of indoor air values than sub-slab soil gas values (EPA, 2015).

8 – Risk evaluation should consider the cumulative effects of multiple chemicals. If multiple attributable contaminants of concern are detected in indoor air or soil gas, consult with the Human Health Risk Assessor for your site.